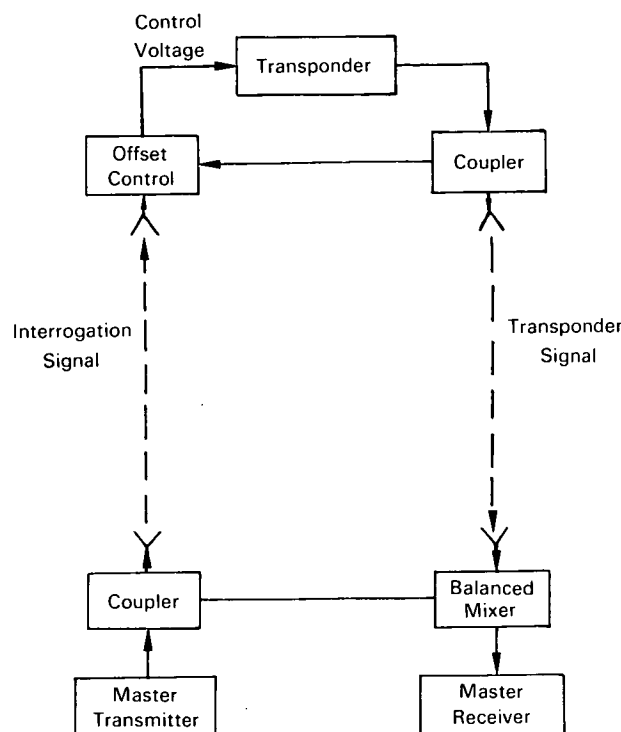


NASA TECH BRIEF



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Frequency Offset In Linear FM/CW Transponder Eliminates Clutter



The problem: To eliminate false echoes or reflections (clutter) of the signal used to interrogate the linear FM/CW transponder located on airborne vehicles.

The solution: Offset the frequency of the transponder signal with respect to the interrogation signal.

How it's done: As shown in the illustration, the interrogation signal from the master transmitter is radiated through a coupler to the airborne transponder. The transponder receives this signal through

an offset control. The offset control generates a control voltage by comparing the frequency of the interrogation signal to that of the transponder signal. This control voltage changes the frequency of the transponder signal so that it remains constantly offset from the frequency of the interrogation signal. At the master receiver, a portion of the interrogation signal is coupled to a balanced mixer. The transponder signal received by the master receiver is beat against the interrogation signal. The frequency of the beat signal is proportional to transponder range, provided the system is using an FM/CW altimeter. In an FM/CW

(continued overleaf)

altimeter using linear modulation, the frequency difference associated with a range between two points is: $f = f_0 + 2R/C$ where f is the sweep rate, R is the range, and C is the velocity of light. Without frequency offset, the frequency of the beat signal in the master receiver is also a function of transponder time delay. Because of this, signals reflected from false targets whose time delays, because of range, are equal to that of the desired signal will be indistinguishable from the desired signals. These undesirable signals are eliminated by offsetting the transponder frequency.

Notes:

1. Suggested application is in any situation where tracking an aircraft or space vehicle is to be performed using FM/CW transponders.

2. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama, 35812
Reference: B65-10146

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated.

Source: Melpar, Incorporated
under contract to Marshall Space Flight Center
(M-FS-249)